



①

AD-A145 838

IRANIAN LONG PERIOD ARRAY SUPPORT

SEMIANNUAL REPORT

1 APRIL 1978 THROUGH 30 SEPTEMBER 1978

Prepared by

John G. Wester and Kenneth F. Heath

TEXAS INSTRUMENTS INCORPORATED

Equipment Group

P.O. Box 6015

Dallas, Texas 75222

AFTAC Project Authorization Number: VELA T/8701/B/PMP

Contract Number: F08606-78-C-0014

Date of Contract: 1 October 1977

Contract Expiration Date: 30 September 1978

Amount of Contract: \$133,220

Short Title of Work: ILPA Support

DTIC
ELECTE
SEP 24 1984
S B

Prepared for

AIR FORCE TECHNICAL APPLICATIONS CENTER

VELA Seismological Center

312 Montgomery Street

Alexandria, Virginia 22314

30 September 1978

AD 134919

Acknowledgement: This work is sponsored by the Advanced Research Projects Agency (ARPA), Department of Defense and accomplished under the technical direction of the Air Force Technical Applications Center, VELA Seismological Center.

CLEARED FOR OPEN PUBLICATION UNDER
THE PROVISIONS OF AFR 190-17.

16 MARCH 1979
INFO SCTY BR., IG
AFTAC

APPROVED FOR PUBLICATION
DATE 10/1/79

Equipment Group

84 09 13 048

DTIC FILE COPY



ABSTRACT

This report summarizes activities under the program of technical support for the Iranian Long Period Array. The Iranian Long Period Array system consists of an array of seven remote seismic sensor installations, data communication links, and a central recording station. Personnel from the University of Tehran Institute of Geophysics operate the system. An on-site technical representative has been provided by Texas Instruments under contract from the Air Force Technical Applications Center to support operation and maintenance of the system and to provide training in these areas for designated personnel. Support services are also provided in the areas of furnishing consumable supplies, spare parts, engineering changes, etc. This report summarizes the major operation and maintenance problems encountered, outlines the training program, and lists recommended changes or improvements in the operation and maintenance of the system.

Neither the Defense Advanced Research Projects Agency nor the Air Force Technical Applications Center will be responsible for information contained herein which has been supplied by other organizations or contractors, and this document is subject to later revision as may be necessary. The views, conclusions, and recommendations presented are those of the authors and should not be interpreted as necessarily representing the official policies, either expressed or implied, of the Defense Advanced Research Projects Agency, the Air Force Technical Applications Center, or the US Government.

PRECEDING PAGE BLANK-NOT FILMED



TABLE OF CONTENTS

SECTION	TITLE	PAGE
	ABSTRACT	iii
I.	INTRODUCTION	I-1
II.	SUMMARY OF EVENTS	II-2
	A. MAINTENANCE	II-1
	B. OPERATION	II-1
	C. TRAINING	II-1
	D. SUPPORT SERVICES	II-2
	E. PERSONNEL	II-2
	F. SYSTEM STATUS	II-2
III.	SUBSYSTEM OPERATIONS	III-1
	A. CENTRAL PROCESSING UNITS (CPU)	III-1
	B. TIMING SUBSYSTEM	III-2
	C. MAGNETIC TAPE RECORDERS	III-2
	D. DRUM RECORDERS	III-2
	E. DEVELOCORDERS	III-2
	F. CRS POWER	III-3
	G. TELEMETRY	III-3
	H. REMOTE POWER	III-4
IV.	ARRAY PERFORMANCE	IV-1
V.	RECOMMENDED SPARE PARTS	V-1

UNCLASSIFIED

SECURITY CLASSIFICATION OF THIS PAGE (When Data Entered)

REPORT DOCUMENTATION PAGE		READ INSTRUCTIONS BEFORE COMPLETING FORM
1. REPORT NUMBER 7554-781	2. GOVT ACCESSION NO AD-A145838	3. RECIPIENT'S CATALOG NUMBER
4. TITLE (and Subtitle) IRANIAN LONG PERIOD ARRAY SUPPORT SEMIANNUAL REPORT		5. TYPE OF REPORT & PERIOD COVERED SEMIANNUAL 1 APRIL 1978 - 30 SEPT. 1978
7. AUTHOR(s) JOHN G. WESTER KENNETH F. HEATH		6. PERFORMING ORG. REPORT NUMBER
9. PERFORMING ORGANIZATION NAME AND ADDRESS TEXAS INSTRUMENTS INCORPORATED EQUIPMENT GROUP DALLAS, TEXAS 75222		8. CONTRACT OR GRANT NUMBER(s) F08606-78-C-0014
11. CONTROLLING OFFICE NAME AND ADDRESS AIR FORCE TECHNICAL APPLICATIONS CENTER VELA SEISMOLOGICAL CENTER 312 MONTGOMERY ST., ALEXANDRIA, VA. 22314		10. PROGRAM ELEMENT, PROJECT, TASK AREA & WORK UNIT NUMBERS T/8701/B/PMP
14. MONITORING AGENCY NAME & ADDRESS (if different from Controlling Office)		12. REPORT DATE 30 SEPTEMBER 1978
		13. NUMBER OF PAGES 14
		15. SECURITY CLASS. (of this report) UNCLASSIFIED
16. DISTRIBUTION STATEMENT (of this Report) APPROVED FOR PUBLIC RELEASE DISTRIBUTION UNLIMITED		15a. DECLASSIFICATION/DOWNGRADING SCHEDULE
17. DISTRIBUTION STATEMENT (of the abstract entered in Block 20, if different from Report)		
18. SUPPLEMENTARY NOTES		
19. KEY WORDS (Continue on reverse side if necessary and identify by block number) IRANIAN LONG PERIOD ARRAY SEISMIC STATION STATION PROCESSOR		
20. ABSTRACT (Continue on reverse side if necessary and identify by block number) This report summarizes activities under the program of technical support for the Iranian Long Period Array. The Iranian Long Period Array system consists of an array of seven remote seismic sensor installations, data communication links, and a central recording station. Personnel from the University of Tehran Institute of Geophysics operate the system. An on-site technical representative has been provided by Texas Instruments under contract from the Air Force Technical Applications Center to support operation and maintenance of the system and to provide training in these areas for designated personnel. Support		

DD FORM 1, JAN 71 1473 EDITION OF 1 NOV 65 IS OBSOLETE

UNCLASSIFIED

SECURITY CLASSIFICATION OF THIS PAGE (When Data Entered)

PRECEDING PAGE BLANK-NOT FILMED

(6) (S)

UNCLASSIFIED

SECURITY CLASSIFICATION OF THIS PAGE (When Data Entered)

services are also provided in the areas of furnishing consumable supplies, spare parts, engineering changes, etc. This report summarizes the major operation and maintenance problems encountered, outlines the training program, and lists recommended changes or improvements in the operation and maintenance of the system. +7



Accession For	
NTIS GRA&I	<input checked="checked" type="checkbox"/>
DTIC TAB	<input type="checkbox"/>
Unannounced	<input type="checkbox"/>
Justification	
By	
Distribution/	
Availability Codes	
Avail and/or	
Dist	Special
A-1	

PRECEDING PAGE BLANK-NOT FILMED

UNCLASSIFIED

SECURITY CLASSIFICATION OF THIS PAGE (When Data Entered)



SECTION I INTRODUCTION

The Iranian Long Period Array (ILPA) system is a seismic installation consisting of a central recording station (CRS) and an array of seven remote sites. Data received from the array is processed at the central recording station. Each remote site is made up of a three-component sensor system, data acquisition subsystem, telemetry subsystem, and power subsystem. The CRS consists of a station processor, a visual recording subsystem, a magnetic recording subsystem, a timing subsystem, a telemetry subsystem, and a power subsystem. Both long period (LP) and short period (SP) seismic data are recorded by the system. The system was established by a government-to-government agreement between the United States of America and the Imperial Government of Iran. Personnel from the University of Tehran Institute of Geophysics (UTIG) operate the system. The CRS is located in Tehran, Iran and the remote sites are centered in an area approximately 65 kilometers southwest of Tehran.

AFTAC has contracted with Texas Instruments Incorporated, under contract number F08606-78-C-0014, to provide technical support for the operation, maintenance, and continued training of UTIG personnel. This is a continuation of effort started under contract F08606-77-C-0016.

Tasks performed by Texas Instruments under the present contract include providing an on-site technical representative to support maintenance and operation of the system and to provide training in these areas for designated personnel. Support services are also provided in the areas of spare parts, consumable supplies, engineering changes, and emergency engineering services.

Events for the six month period ending 30 September 1978 are summarized in Section II. Operations of each of the subsystems are discussed in Section III. Reports on the array performance are referenced in Section IV. Section V outlines tape recorder spares that Texas Instruments recommends that AFTAC procure for ILPA use in Iran.

PRECEDING PAGE BLANK-NOT FILMED



SECTION II

SUMMARY OF EVENTS

The purpose of this project is to provide technical support and training for the ILPA staff in the operation and maintenance of the array and its associated equipment. To accomplish this, Texas Instruments is providing an on-site technical representative to assist and train designated personnel on the program. Support services for the system are also provided by Texas Instruments. The program has been conducted by Texas Instruments under this contract and an earlier contract under the management of the Air Force Technical Applications Center (AFTAC) since 1 October 1976.

Activities during the past six months of the current program (1 April 1978 to 30 September 1978) have been categorized as being primary maintenance, operation, training, or support functions. However, each of the maintenance and operations activities include facets of the continuing training effort.

A. MAINTENANCE

The primary maintenance activity accomplished during this reporting period consisted of regularly scheduled maintenance required for each of the subsystem components. Subsystem components requiring extra attention in the area of maintenance are noted in Section III. The limited number of personnel available for carrying out maintenance activities has dictated that some of the non-critical maintenance effort be postponed or cancelled.

B. OPERATION

System operation continues to be handled primarily by personnel from the UTIG. UTIG personnel also handled all transportation to the field sites and all administrative duties associated with operation of the system. All event detection and reporting was performed by personnel from UTIG. All sites, with the exceptions of 5 and 6, were again calibrated during this report period.

C. TRAINING

Training has progressed as rapidly and as extensively as possible with the limited availability of personnel during the past six months. This has been primarily on-the-job training with limited formal training in specific areas. The limited number of people assigned to the program and the multiplicity of other responsibilities indicate that future training efforts will probably continue in this manner.



D. SUPPORT SERVICES

Spare parts for the system were shipped to the CRS via AFTAC/VSC throughout this report period as they were received in Dallas from the vendors. All of the different spares items on order during this reporting period were received and forwarded to AFTAC/VSC.

Section V consists of a list delineating the spare parts for the magnetic tape recorders which Texas Instruments recommends that AFTAC procure for ILPA use during 1979.

E. PERSONNEL

Mr. Kenneth F. Heath has been Texas Instrument's on-site technical representative during this reporting period at which time he had completed eight months in this capacity. It is planned that he will continue in this assignment for the remainder of the contract. Should any personnel changes be required, however, AFTAC/VSC will be apprised of such changes prior to any action being taken.

F. SYSTEM STATUS

Status of the system, as reported to Dallas, is shown in Figure II-1.

01511

NOTES:

- 1 TEG MALFUNCTION
- 2 SITE TURNED OFF
- 3 SYNC LOSS, NO DATA
- 4 SITE HAS INTERMITTENT NOISE
- 5 DATA LOST, CABLE BASED TRANSMITTER

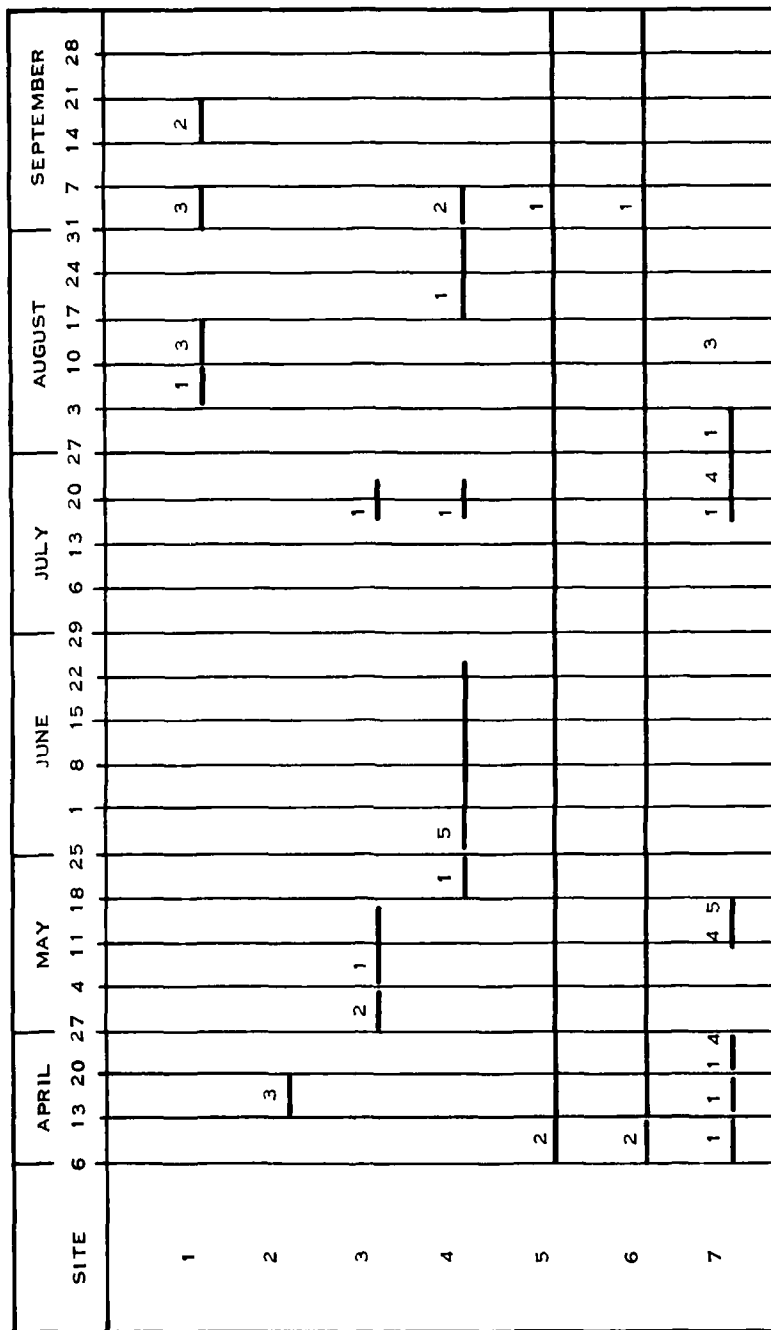


FIGURE II-1. SYSTEM STATUS



SECTION III SUBSYSTEM OPERATIONS

Subsystem operations continued to improve during the six month period ending 30 September 1978. However, problems were experienced with the remote power subsystems and the power at the CRS.

It appears that the UTIG personnel associated with the ILPA system have continued to have a number of other responsibilities in addition to the ILPA work during the past six months. Despite these added responsibilities, most of the system maintenance problems were resolved as soon as they occurred.

Performance of each of the subsystems during this report period is discussed in the following paragraphs.

A. CENTRAL PROCESSING UNITS (CPU)

During May, Carolyn Hasbrouck and Emma Hill of Texas Instruments isolated a CPU problem which resulted in intermittent shorting of the signal and the loading of all CPU 1 into memory. Replacing a single wire allowed loading from CPU 2 into memory as well as CPU 1.

During June, failure of memory boards in CPU 2 resulted in a failure to record short period data using CPU 2. The recording of all short period and long period data was adequately handled by CPU 1 until CPU 2 was partially repaired during July. During June, CPU 2 was still capable of recording long period data.

During July, a front panel sense switch and a memory board were replaced in CPU 2. This corrected a majority of the problems previously experienced.

During August, a timing problem with CPU 2 was experienced. When CPU 2 came on-line, all data was lost and CPU 2 had to be reset. Several fixes were attempted with no real success.

Texas Instruments recommends that AFTAC/VSC consider replacing the existing TI 980A CPU 1 and CPU 2 with the newer model TI 980B.

During September, the CPU 2 at the CRS encountered problems and prevailed throughout most of the month. Problems with the CPU resulted in loss of data for almost all of the 4 week period. At the end of the month, the problem had still not been resolved.



B. TIMING SUBSYSTEM

During May, it was believed that a Time Code Generator (TCG) problem existed between the CRS and site 4. This was later discovered not to be the case.

During September, it was discovered that at the CRS, CPU2 had a timing error, which resulted in a loss of data when on line with tape transport 3. CPU2 was repaired during October-November.

C. MAGNETIC TAPE RECORDERS

During this reporting period, problems continued with the proper operation of the tape recorders. Tape Transport 3 was giving bad status because the speed was not right and there was no way to check the tape speed. At a later date a speed indicator that had been stored in the garage was found, and after adjusting the tape speed, the status problem cleared up and Tape Transport 3 worked O.K.

Tape Transport 3 was the only one to give bad status and the off-line. There are no spare heads nor is there any way to align them if they were replaced. Texas Instruments recommends that AFTAC purchase the spare parts listed in Section V of this report to ensure a proper stock of spares at the CRS. Further, Texas Instruments recommends that AFTAC purchase a spare tape recorder from PERTEC and initiate a maintenance agreement with PERTEC that would allow CRS personnel to send one of the tape recorders to PERTEC for overhaul every six months.

During September, it was reported that an engineering student (referred to in the September 6 report) has been recommended to be hired in order to take care of the CRS. Mr. Soltanian will then work the field.

D. DRUM RECORDERS

During late August and early September, the short period drum recorder's pen motor failed. Several spares were installed. It was discovered that all spare motors had the wrong r.p.m. rate. The motor from the monitor drum was installed in the short period drum recorder and proper operation was restored.

E. DEVELOCORDERS

During this reporting period, several repairs were made to the develocorders. During April, the galvanometer went bad and the on-line develocorder had to be disassembled for repairs. During June, the time fiducial for the long period develocorder failed and spare parts were ordered. Spare



parts were received for the long period and short period develocorders; however, installation of the spare parts did not immediately fix the develocorders. Capacitor C6 was discovered to be in the open position. This was corrected and the long period develocorder resumed operation. K5 on the relay register in the signal conditioning unit was fixed and the short period develocorder resumed operation. During July, the time fiducial for the short period develocorder failed.

Late in July, the galvanometers in both develocorders failed and spares had to be placed on order.

During August and September the LP Develocorder continued to malfunction. It was determined that the Develocorder needed a float and water storage tank. By the end of September, the problems concerning the LP Develocorder still existed.

F. CRS POWER

Maintaining constant no-break power at the CRS continued to be a problem during the reporting period. During the first week of April, power was lost at the CRS for a 16 hour period. The back-up generators did not function properly. However, later in the month commercial power failed frequently and the back-up generator functioned properly every time. The back-up generator works only part of the time because it needs a tune-up and a new battery. The generators only came on once a week and ran about 30 minutes; the purpose of this was to keep the battery charged. Ken Heath suggested starting both generators each day and letting them run about 10 minutes to keep the battery charged up. There were no problems with either generator after this procedure was initiated.

During May, several days of data were lost because of the frequent switches required from commercial to back-up generator power. The system loses data even if power is lost for only a moment.

During July, commercial power failed and the large generator did not start. The small generator did start but did not function properly and thus it could not handle the power requirements of the CRS. Repair of the generator lead to the replacement of the engine control monitor for the large generator and a carburetor cleaning and spark plug change for the small generator. Proper operation of both generators was restored.



During the remaining portion of the reporting period, several additional maintenance functions were accomplished on the generators including the cleaning of radiator fins to correct an overheating problem. By the end of September, however, the CRS was still encountering problems.

G. TELEMETRY

The telemetry subsystem functioned satisfactorily for all operating sites except site 7. No telemetry was received from sites 5 and 6 during this reporting period due to the fact that these two sites were turned off. Site 5 and 6 will be reactivated after the receivers and transmitters for these sites have been realigned by AFTAC and returned to IRAN.

During July, telemetry was at site 7 during the morning hours. The telemetry would clear up about noon of each day and continue until the next morning. The cause of this problem was never isolated but it stopped by itself by the end of the month.

H. REMOTE POWER

Improvements implemented in the TEGs during the last reporting period did not totally stop down time as a result of TEG malfunction during this reporting period.

During April, site 7 was visited three times. The first trip resulted in fixing a gas line leak and replacing a clogged filter. The second trip resulted in the installation of a new regulator. The third trip resulted in the replacement of the regulator installed on the second trip.

During May, site 3 was visited. The first trip was initiated to switch fuel tanks and restart the TEG. However, it was discovered that the calibrator was malfunctioning and had to be returned to the CRS for repair. The calibrator was repaired and the TEG restarted.

Late in July, sites 3, 4 and 7 went down almost simultaneously. Low fuel supplies for the TEG was suspected to be the problem. However, sites 3 and 7 started again before a field trip could be made. A trip to site 7 in early August resulted in the replacement of the TEG regulator after the site went down again. A trip to site 3 discovered the need to refuel the site. This was accomplished during August.

During August, site 1 went down and required refueling. This was accomplished. Late in August site 4 went down and required refueling. Refueling of site 4 was delayed due to personnel illness.



During September, site 4 went down due to low voltage.

Sites 5 and 6 continued to be down due to the receiver and transmitter being in the United States for alignment.

Although the signal was very weak, a transmitter was replaced at site 1 which enabled contact to be made with the CRS.



SECTION IV ARRAY PERFORMANCE

Evaluation of the Iranian Long Period Array was performed under contract F08606-77-C-0004 by Texas Instruments Incorporated at the Seismic Data Analysis Center in Alexandria, Virginia. Performance of the array is discussed in reports under that contract.



SECTION V
RECOMMENDED SPARE PARTS

The following is a list of recommended spare parts for the magnetic tape recorders. It is recommended that these parts be procured to ensure proper maintenance capability during 1979.



	Quantity	Part No.
Fixed Guide Assy	1	101026-01
Roller Guide	1	100808-01
Hub	1	100792-01
Tension Arm	1	100858-02
Write Lockout	1	101003-01
Reel Servo Assy	1	101004-01
EOT/BOT Amp PCBA	1	101949-01
Extender Card	1	101206-01
Servo Drive Belt	1	610-0007
Grip Ring, Reel Retainer		100117-01
Control Assy - Load Switch	1	505-1803
Control Assy - On Line Switch	1	505-1804
Control Assy - Rewind Switch	1	505-1805
Control Assy - WRFEN Switch	1	505-1806
Control Assy - 1600 CPI Switch	1	505-1827
Control Assy - Forward Switch	1	505-1808
Control Assy - Reverse Switch	1	505-1809
Control Assy - Power Switch	1	505-1801
Relay - 4 POT, 12V 3 Amp	3	502-1242
Microswitch	1	E63-13K
Relay Time Delay		CHB-38-70001
Shim-Head Guide	1	100298-01
Reel Servo Motor	2	101004-01
Photo Tab Assy	2	100807-01